Internal Letter Rockwell International

9514

Date April 7, 1988 No.

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FROM (Name, Organization, Internal Address, Phone)
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SUBJECT: DEVELOPMENT TESTS FOR THE 903 PAD, EAST TRENCHES, AND MOUND AREAS

Per your request, I have summarized the tests Process Technology Development (PTD) plans on conducting to determine the most feasible technologies for removing metals and actinides from contaminated soil and groundwater at the 903 Pad/Trenches/Mound Areas. Each description addresses the necessity and potential benefits for each test, and possible risks involved if the test is not conducted. Keep in mind that each of these technologies only reduce the volume of metal and actinide contaminated groundwater and soil. Subsequent treatment processes will have to be developed before the concentrated contaminants are ready for proper disposal. A schedule for the proposed tests is attached.

Metal Adsorption on MRA

A biomass material called Metal Recovery Agent (MRA) has been developed by Advanced Mineral Technologies (AMT) of Golden, CO. According to AMT, this material can be used to remove metals (including non-radioactive heavy metals) from water. Laboratory- and pilot-scale testing and full-scale systems have proven that MRA is reliable. However, no testing has been done to determine the usefulness of MRA in removing actinides from water. The study proposed by PTD is to obtain some MRA, and with assistance from AMT, determine the effectiveness of MRA in removing actinides from water. The laboratory test will be performed by Bob Kochen in Aqueous Recycle Technology (ART) with possible assistance from Scott McGlochlin, Support Process Systems Development (SPSD). Positive test results may be used to design full-scale equipment for actinide removal. A contract may be issued to AMT to run their own tests using MRA to remove specific non-radioactive metals found in Rocky Flats groundwater.

The potential benefits of this technology are: 1. Actinide removal would be accomplished without having to pretreat the water or significantly change the pH. 2. The MRA material can potentially be regenerated at Rocky Flats. 3. The possibility that all metal removal from groundwater can be accomplished using one process.

A risk of not pursuing this technology is the possibility of having to include pretreatment and pH adjustment processes prior to other groundwater treatment units (increasing cost). There may be some negative feedback from the Colorado Department of Health (CDH) and the Environmental Protection Agency (EPA) as to why Rocky Flats did not pursue this potentially viable technology further.

"REVIEWED FOR CLASSIFICATION"
By A. J. Kallas
Date 4/12/88

Metal Adsorption on Activated Carbon

This study is intended to determine if actinides in contaminated 903 Pad/ Trenches/Mound groundwater can be adsorbed onto granular activated carbon (GAC). Positive test results will enable GAC to be considered for removing volatile organic compounds (VOC's) and actinides from groundwater. Subsequently, GAC may be tested to determine its efficiency in removing non-radioactive metals (i.e. selenium) from groundwater. An additional benefit of this study is that it will determine the extent of actinide loading on carbon. If it is determined that actinides significantly load onto carbon, subsequent evaluations of GAC to remove VOC's from groundwater must include the cost of either an onsite GAC regeneration facility or the cost of shipping the loaded GAC to the Nevada Test Site for disposal. Bob Kochen will also be performing this study.

The benefits of this test are twofold: 1. Successful test results may enable the use of one technology to decontaminate actinide and VOC contaminated groundwater. 2. The question of actinide loading on GAC will be answered. Without this study, treatment technologies that only remove metals will have to be considered for the removal of actinides from groundwater. These technologies do not have the added benefit of also removing VOC's. Pretreatment and pH adjustment will possibly be required for alternate treatment technologies, potentially causing a significant increase in costs. Carbon adsorption, the most proven technology for removing VOC's from groundwater, will probably not be considered for VOC removal as long as no data exists with regard to its actinide loading capability.

Metal Adsorption and VOC Removal/Destruction Tests

The possibility exists that other innovative treatment technologies may be discovered during the Feasibility Study process. Treatment technologies for VOC and/or metal/actinide removal that have not been proven or require limited laboratory testing to assure their usefulness may necessitate examination by PTD. Alternately, offsite testing by vendors may be chosen. Since it is not possible to list potential experiments specifically, this category was listed in case new technologies require further investigation.

Column Test (Ferrite) for Actinide Removal

A proven technology previously used at Rocky Flats for removing actinides from water is treatment with ferrite (magnetite). The process requires ferrite to be added to a contaminated solution. With the pH in the 11 to 13 range, actinides adsorb to the ferrite. A flocculating agent is added to the slurry to improve settling and separation. The sludge settles to the bottom of the vessel, then removed and disposed of, ferrite and all. The clean effluent remains. In this study, actinide contaminated water at a high pH will be passed through a column filled with ferrite to determine the efficiency of actinide removal.

The use of ferrite in a column will significantly reduce the amount of waste that must ultimately be handled. Once the ferrite is loaded with actinides, the column can be backflushed with a mild acid to remove the actinides, allowing reuse of the ferrite in the column. The concentrated metal contaminated stream will require further processing prior to disposal.

Without the proposed test, the continuous replacement and disposal of spent ferrite will significantly inflate the treatment cost of the ferrite process, which may result in the choice of an inferior treatment technology. Since this is the most proven metal/actinide removal process, it behooves Rocky Flats to examine simple technology improvements that may significantly reduce operating and capital costs. Bob Kochen will perform the ferrite test.

Mineral Jig Tests

The use of a mineral jig to separate heavy metals from soil (actually coral) was successfully proven at Johnston Island. Some Rocky Flats soils have been tested on the same pilot-scale mineral jig used at Johnston Island with limited success[1]. Bob Kochen from ART has a small mineral jig to process Rocky Flats actinide contaminated soil and determine its usefulness and efficiency.

The mineral jig would be the final stage in a three stage process intended to reduce the volume of contaminated soil by 75 to 85 percent. The first stage involves a soil washing technique which will reduce the total volume of contaminated soil by 60 to 70 percent. The second stage uses an attrition scrubbing technique to reduce the remaining volume of soil by an additional 25 to 33 percent. The third stage uses a mineral jig to reduce the volume of the remaining soil by an additional 10 to 15 percent.

The mineral jig process is the final stage of the most probable technology for reducing the volume of contaminated soil on the 903 Pad/Trenches/Mound. A number of questions will be answered by performing the laboratory-scale work. First, the actinide removal efficiency using a mineral jig on actual Rocky Flats soil will be evaluated more thoroughly than what was done in the previous study. The previous work failed to retain proper identification for the samples submitted, in addition to improperly calculating material balances. Second, important data will be obtained in order to upsize the equipment for pilot- or full-scale application. Finally, this data could then be used to estimate equipment and operating costs for the chosen mineral jig system. These costs will be compared with the cost of disposing the concentrated soils offsite. The potential use of a mineral jig as a secondary treatment rather than a tertiary treatment may also be determined from this study.

Obviously the impact of not performing this test is rather significant. Useful data on Rocky Flats soil will not be available, requiring speculation on all subsequent decisions regarding efficiency, sizing, cost, and cost comparisons. A feasible technology for reducing the volume of contaminated soil will not be developed.

Pilot-Scale Tests for Soil Decontamination

A "pilot-scale" test was done in 1980 using soil washing and attrition scrubbing to remove actinides from soils[2]. The previous test was actually conducted on more of a laboratory-scale basis rather than pilot-scale according to the report. The report suggested that pilot-scale development work be conducted to properly up-size equipment to meet Production requirements.

The obvious lack of pilot-scale data supporting the use of these technologies would make it virtually impossible for Waste Operations, Health, Safety and Environment (HS&E), EPA, CDH or the public to approve the use of a full-scale soil washing/attrition scrubbing/mineral jig system to decontaminate Rocky Flats soils. PTD recommends that a pilot-scale system be designed and tested on the contaminated sites using actual contaminated soils.

A pilot-scale test would provide valuable data needed to assure Rocky Flats and the public that a soil washing, attrition scrubbing, mineral jig system will remove actinides from soil to acceptable limits. Without pilot scale testing, PTD will use laboratory data as a basis for all engineering decisions in up-sizing to a full-scale treatment process. Many assumptions will be used in determining what type of full-scale equipment may be needed. The foremost assumption is that the soil washing/scrubbing/jig system will work as efficiently as it did on a laboratory-scale basis (which was not all that efficient). To deviate from this assumption will further complicate matters. Furthermore, the previous study retained a recycle loop for contaminated water used to wash the soil. The recycle loop may not be retained in our proposed pilot-scale study.

A scenario: The cost estimate for a full-scale soil washing, attrition scrubbing, mineral jig system to decontaminate the soil at the sites is based upon laboratory-scale data (don't forget the first assumption is that the full-scale process is designed using laboratory-scale data). The cost estimate is favorable compared to other treatment alternatives, including shipping the soil offsite. A treatment facility is built, and processing of soils begins. Rocky Flats determines that the process does not fully decontaminate the soils, and must ship the soils offsite anyway. As you can see, a significant amount of money has been spent in earnest. I hope I have shown how ludicrous it would be if PTD were to use laboratory information to base major decisions on. A pilot-scale unit is the stepping stone PTD and Rocky Flats requires to assure ourselves that the soil washing, attrition scrubbing, mineral jig system will indeed decontaminate our soils.

A proposed schedule for pilot-scale testing using this system is attached. Please note that Facilities Engineering, HS&E, and other groups on plantsite will be involved quite extensively in the process of designing and obtaining a pilot-scale unit.

If you have any questions regarding any of the information in this letter, please contact me.

A. J. Kallas
Chemical Process Systems Development

REFERENCES:

1. Sunderland, Norman R., The Removal of Plutonium Contamination From Rocky Flats Soils, AWC Nuclear Services, Inc., Las Vegas, NV, May 26, 1987.

2. Garnett, John E., Doyle L. Mitchell, Peter T. Faccini, Initial Testing of Pilot Scale Equipment for Soil Decontamination, Rockwell International, Rocky Flats Plant, RFP-3022, October 17, 1980.

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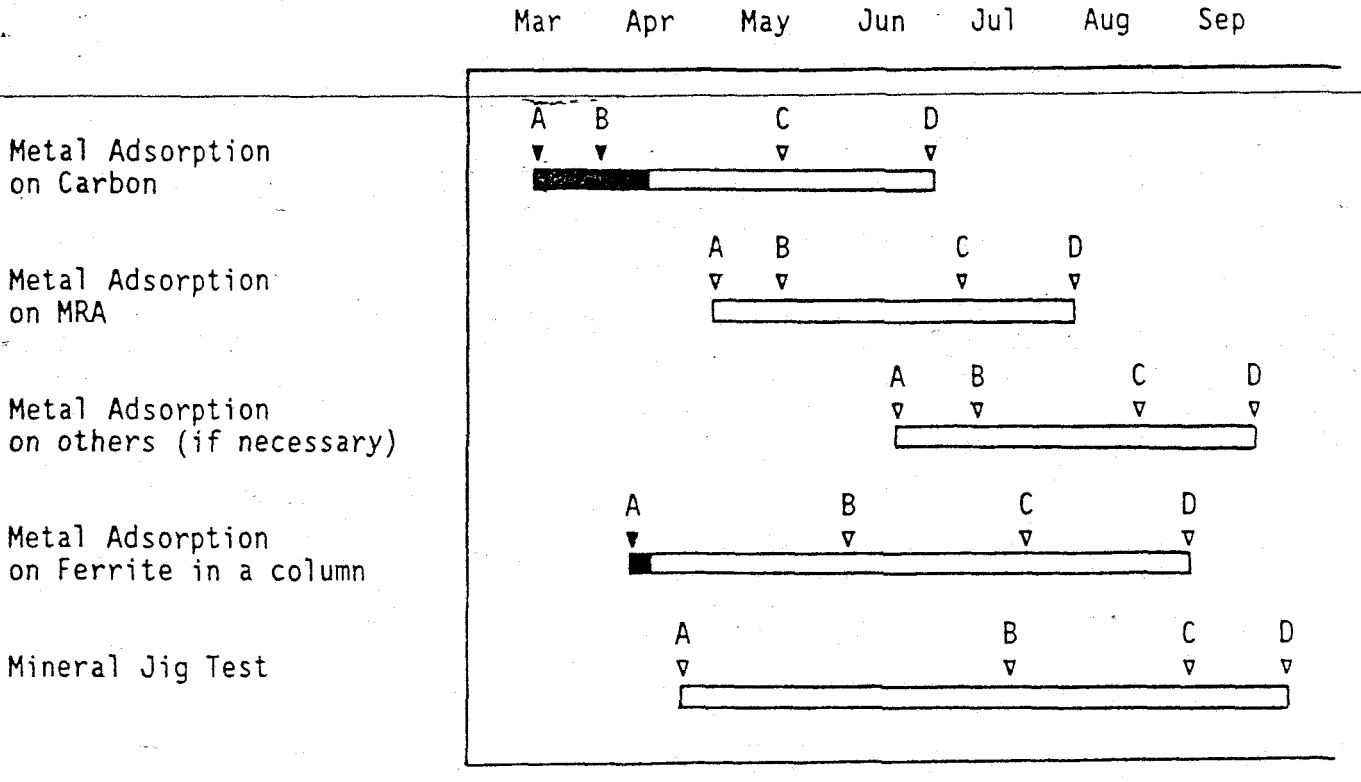
PTD DEVELOPMENT STUDIES FOR
903 PAD, EAST TRENCHES, AND MOUND
FEASIBILITY STUDY



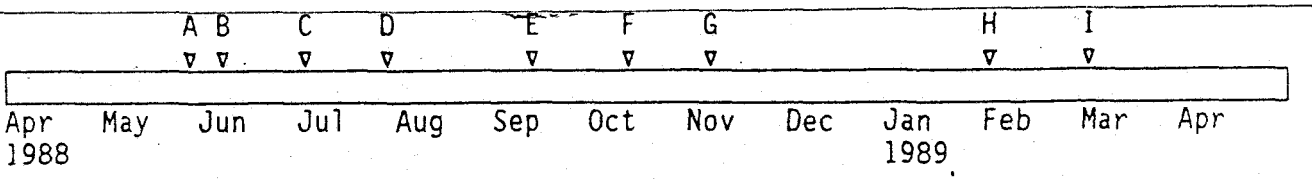
A Set up equipment, begin laboratory testing, start sending samples to lab

B Complete experiment, laboratories begin testing of samples to determine removal efficiency

C End laboratory analysis, begin assessing data and writing report

D Issue report and recommendations

PROPOSED SCHEDULE FOR PILOT-SCALE TESTING
OF A SOIL WASHING, ATTRITION SCRUBBING SYSTEM
TO DECONTAMINATE ROCKY FLATS PLANT SOILS



A Assess need for pilot-scale tests, receive commitment from Waste Operations, Facilities Engineering, Health, Safety and Environment, Development, etc.

B Begin design criteria, determine location for testing

C Complete design criteria, begin engineering design

D Complete engineering design, issue package for bidding

E Receive bids, order equipment

F Receive equipment, begin installation

G End installation, start-up equipment and begin development work to optimize system

H Complete development work, begin assessing data and writing report

I Issue final report and recommendations